



## Lesson 1: Pre-Visit

### *Know your Trees*

#### Materials:

- \* Tree pictures (provided at end of packet) or branches from different coniferous trees.
- \* Dichotomous tree keys



#### Vocabulary

Dichotomous key, coniferous, heartwood, taproot, lateral roots, xylem, phloem, bark

#### Method

In this activity, students will review the parts of a tree and use dichotomous keys to practice identifying tree species that live in Glacier National Park.

#### Objectives

Students will be able to:

- name the different parts of a tree - heartwood, taproot, lateral roots, xylem, phloem, bark
- identify coniferous trees with a dichotomous key.

#### MT State Science Standard

MT.SCI.K-12.2 Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.

MT.SCI.K-12.3 Students, through the inquiry process, demonstrate knowledge of characteristics, structures and function of living things, the process and diversity of life, and how living organisms interact with each other and their environment.

#### Next Generation Science Standard

MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.

- Crosscutting concept: Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation.

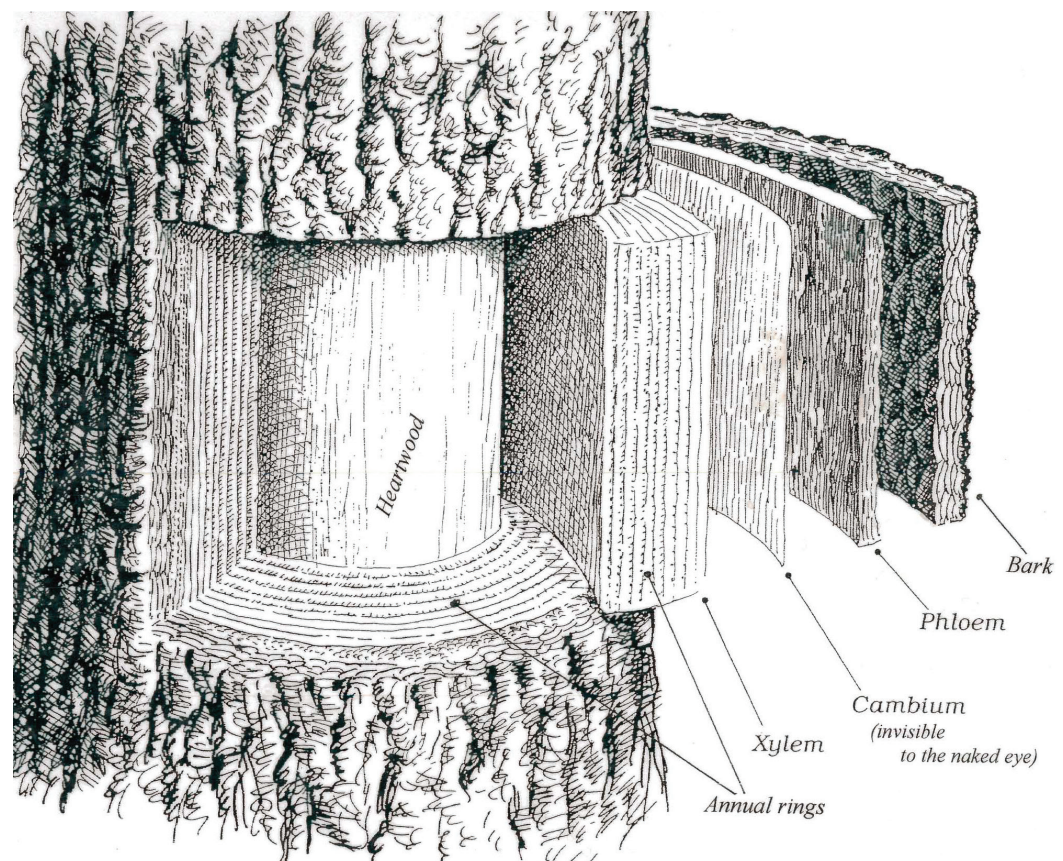
#### Background

In 2008-2009, there were over 80 ongoing research studies or monitoring projects being conducted in Glacier National Park on cultural resources, history, social sciences, air, water, geological resources, climate, fire, ecosystem processes, vegetation, and wildlife. Some studies are conducted by university graduate students and professors and others are conducted by permanent National Park Service and USGS (United States Geological Survey) staff with assistance from seasonal research technicians. However,

as Glacier National Park has undergone dramatic changes this past decade, much of what park scientists and researchers do is to monitor the changes that are occurring and look for patterns in order to make reliable predictions for the future. This monitoring information is then shared with park division chiefs who use the data to make management decisions about the park.

Before a researcher can collect data on the effects of fire in Glacier National Park, they need to be able to identify tree species in the forest. One tool researchers use to identify trees is called a dichotomous key. Dichotomous keys present a user with sets of questions that eventually lead to an identification. The dichotomous key that students will use in this lesson requires them to look at needles, tree shapes, and sometimes cones. At the end of this packet are pictures of five trees found in Glacier National Park: western red cedar (1), western hemlock (2), lodgepole pine (3), western larch (4), and Englemann spruce (5).

In addition to being able to identify trees, researchers need to understand how trees grow and survive. To understand this, they first must know the parts of a tree and their functions. Below is an image showing some of the parts of a tree covered in the Build a Tree activity.



## Procedure

### Part 1: Build a Tree

Use several students to act out the different parts of a tree. Students will perform the role of heartwood, taproots, lateral roots, xylem, phloem, and bark. You can divide your class into groups so that multiple trees are built at the same time.

1. Choose a tall student to be the heartwood of the tree, and have the student stand in the middle of the classroom.. Explain that the heartwood is the innermost section of the trunk, giving strength and support to the rest of the tree.
2. Choose one (or more if you have a group larger than 20) student to be the taproot, having the student sit at the base of the heartwood facing outward. Tell the student to send his strong root deep into the ground, helping to anchor the tree in strong winds and storms. Point out that not all trees have tap roots, as is the case with the western red cedar.
3. Choose 3-4 students with long hair to be the lateral roots, ask them if they mind laying down on the ground, and have them lie on the ground with their feet at the taproot, spiraling out like the spokes of a wheel. Have them spread their hair out, representing the hundreds of lateral roots that spread out in all directions to soak up water from the ground. Tell them, "When I say `slurp!,' you all make a loud slurping noise, like this. Okay, let's practice...slurp!"
4. Choose 3-4 students to be the xylem of the tree, forming a standing circle around the heartwood and taproot, standing over the lateral roots, and facing inward towards the heartwood. The xylem brings the water up from the roots to the branches at speeds up to 100 miles per hour! Have the xylem students hold hands and when you say, "bring the water up!," the students raise their held hands above their head while shouting "Wheeeee!" Practice with the xylem until they understand their role, and test the lateral roots by saying, "let's slurp!"
5. Choose 4-5 students to be the phloem of the tree, forming another standing circle facing inward around the xylem layer. The phloem helps make food for the tree during photosynthesis (green chlorophyll in the leaves uses sunlight, water and carbon dioxide to make sugar and other nutrients for the tree, and releases oxygen for us to breathe), and brings the food down to the roots of the trees. When you say, "let's make food!," direct the phloem students to raise their hands above their heads, and crossing the wrist of the person next to them, flutter their hands to represent leaves soaking up the sun so that photosynthesis can begin. When you say, "bring the food down!," the students are to drop to a crouching position and go "whoooo!" Practice these instructions with the phloem students, and review the roles of the xylem and lateral roots ("bring the water up!," and "let's slurp!").
6. The remaining 5+ students become the bark of the tree, forming an outward facing circle around the phloem layer. The bark protects the tree from insects, animals, disease and fire. Instruct the students to place their arms up in a football block type of position.
7. After you are sure the students understand their different roles, begin the process by giving your instructions in the following order and repeating the underlined directives at least three times: "Stand tall and strong heartwood. Send your strong root deep into the ground taproot. Let's slurp! Let's make food! Bring the water up! Bring the food down! Get tough, bark!"



## Procedure continued

### Part 2: Tree ID

Students will use dichotomous keys to identify five different coniferous trees found in Glacier National Park.

1. Set up 5 stations (cedar, hemlock, lodgepole, larch, and spruce) around the classroom, one station for each tree the students will identify. At each station, place images of the tree species (provided at the end of this packet), or an actual tree branch and a copy of the “Key to Coniferous Trees of Glacier National Park.”
2. Divide students into 5 groups and assign one group to each of the 5 stations.
3. Tell students to use the materials provided to identify the picture or branch of the tree.
4. Have students write number a sheet of paper 1 through 5, and use it to record the species they identify at each station.
5. Rotate students through the stations until all groups have identified all 5 trees.

## Evaluation

On a Smartboard or on a whiteboard draw the following chart and have the students record what species they identified for each tree. This is a quick way to check if any group mis-keyed any of the trees.

|        | Group 1 | Group 2 | Group 3 | Group 4 | Group 5 |
|--------|---------|---------|---------|---------|---------|
| Tree 1 |         |         |         |         |         |
| Tree 2 |         |         |         |         |         |
| Tree 3 |         |         |         |         |         |
| Tree 4 |         |         |         |         |         |
| Tree 5 |         |         |         |         |         |

## Extension

Have students make their own dichotomous keys for plants that they can find around the school (or pictures of plants from the internet). Instructions for making a dichotomous key can be found at <https://www.nps.gov/subjects/biodiversity/upload/Final-Attachment-1-Making-a-dichotomous-key.pdf>

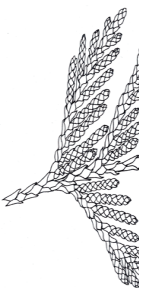


# Key to the Coniferous Trees in Glacier Park

*refer to pictures for definition of italicized words*

1. Tree has needles ..... Go to 2
1. Tree has tiny *scale-like leaves* with flattened branches ... Western Red Cedar

*scale-like leaves*



2. Needles are in *bunches* ..... Go to 3
2. Needles are *single* (come out of the branch 1 at a time) ..... Go to 7



3. Needles are more than 5 in a bunch, in dense brush-like clusters, short, and very soft ..... Western Larch
3. Needles 2 - 5 in a bunch ..... Go to 4

4. Needles in bunches of 2's or 3's ..... Go to 5
4. Needles in bunches of 5 ..... Go to 6

5. Needles 2 in a bunch and about 1.5 inches long ..... Lodgepole Pine
5. Needles mostly 3 in a bunch and very long (5 - 8 inches) .... Ponderosa Pine

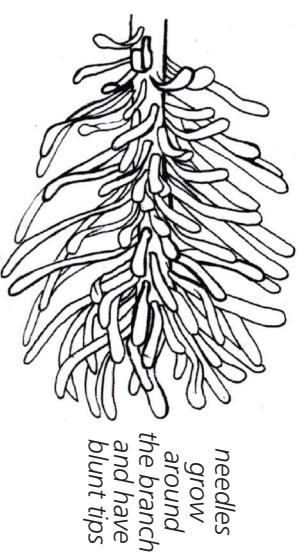
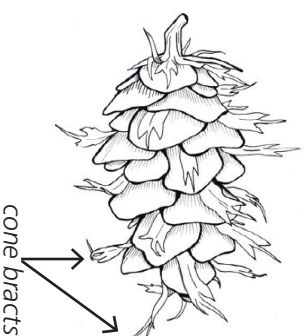


*cone about three times as long as wide*

6. Some needles longer than 3 inches; *cones about 3 times as long as wide*; low elevations ..... Western White Pine
6. Needles less than 3 inches long; cones 2 times as long as wide; scales thicker toward the tip than the base; trunk may be twisted and gnarled; high elevations ..... Whitebark Pine

7. Needles are stiff and sharp to the touch; needles are square and roll between your fingers ..... Engelmann Spruce
7. Needles are flat ..... Go to 8

8. Plant is very small with multiple woody stems (shrub rather than a tree); needles are in rows along the side of the branches; needles have small points at ends; red berries may be present ..... Pacific Yew
8. Plant is a tree (single trunk); needles have blunt (rounded) tips; cones may be present ..... Go to 9



9. Top of tree droops over; short needles with white stripes underneath; cones very small at end of flat branches if present ..... Western Hemlock
9. Top of tree does not droop over; needles longer than 1/2 inch ..... Go to 10
10. Needles grow around the branch (looks like a gun barrel brush or test tube cleaner); needles narrow at base (petiole); Cones have bracts ..... Douglas-fir
10. Wide needles fused to branch; cones do not have bracts ..... Go to 11
11. Needles grow around the branch, and point up; small white stripes occur on both sides of the needles ..... Subalpine Fir
11. On lower branches, needles in two rows along sides, on upper branches needles on all sides of a branch; white striped on underside of needles ..... Grand Fir



turn over --->



















